# APPENDIX C
# TRAP CROPPING AND INSECT CONTROL

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Traditional farming practices such as the production of diverse crops can help reduce the risk of crop failure due to weather and may reduce pest damage to some plants. The reasons for reduced pest damage, or lack of reduced damage, in such diversified habitats are not always clear. However, crop diversification and its potential for insect pest management is of growing interest with some farming operations. One method of diversification is trap cropping, a technique used specifically for pest management.
Insects demonstrate preferences for particular plant species, cultivars or crop stages by responding to certain cues. These cues may be visual, tactile, odiferous, or a combination of stimuli. Plant breeders have been able to exploit some of these preferences by developing plants that pest insects avoid (Smith 1989). Alternatively, insect preferences can be exploited for pest management practices using trap crops.

Trap crops are composed of one or more plant species that are grown to attract insects in order to protect the cash crop from the pest (Hokkanen 1991). Protection may be achieved either by preventing the pest from reaching the crop or by concentrating the pests in a certain part of the field where they can be managed. Trap crops can be manipulated in time or space so that they attract insects at a critical period in the pest's and/or the crop's life cycle. Depending on the insect's biology and management practices available, the population on the trap crop then can be dealt with in several different ways. In some cases, the plants can just withstand the damage and no further action is needed. Additionally, the trap crop can maintain the pest population to serve as a resource on which natural enemies can increase. Natural enemies may suppress the pest population so it does not spill over onto the cash crop, or the trap crop may serve as an initial source of natural enemies that move to the cash crop. Similarly, if there is a concern that pests will move onto the cash crop, they can be dealt with using insecticides or cultural practices such as destroying the trap crop and the insects on it.

## KEY FACTORS

Trap cropping is a knowledge intensive practice and requires an understanding of several factors.

1. The feeding and/or egg laying habits of the pest. The trap crop must be far more attractive to the pest as either a food source or egg laying site than the main crop.

2. Movement patterns of the insect. In most instances, trap cropping is focused on attracting and arresting the movement of adult insects, thus keeping them from moving to the cash crop. If adults are strong fliers and the trap crop is not overly attractive, insects may simply not be captured by the trap crop.

3. Spatial layout of the trap crop. Whether it is best to plant the trap crop around the field or intersperse it within the cash crop depends on the movement patterns of the insect, and there are no general rules to how to plant the trap crop to cover all situations. For example, Colorado potato beetles move from their overwintering sites into new plantings using relatively short-range movements so planting borders around the field may arrest the beetles. However, if European corn borer moths fly into a field they may not be so easily arrested by borders of trap crops. The layout for the trap crop may be different depending on whether the field is long and narrow or square.

4. Proportion of trap crops needed. There needs to be a balance of the proportion of the trap crop to the cash crop that is both economically feasible and effective for pest management. In some recent trials with the diamondback moth on cabbage, it appears that about 20% of the field is required when using a trap crop.

5. Fate of insects on trap crops. Unless the immature stages of the insect pest die before reaching the adult stage, insect pest movement from the trap crop to the main crop is likely to occur later in the season. Therefore, it is important to monitor the trap crop regularly. Recent work has focused on finding what are termed "dead-end trap crops". These plants would be highly attractive for eggs laying but larvae would not be able to survive on them. An example of this type of plant is yellow rocket used as a trap crop for diamondback moth (Shelton and Nault 2004). In greenhouse trials the egg laying preference for yellow rocket varied between 24-66 fold over cabbage but no larvae were able to develop on yellow rocket. Trials are underway to determine the optimal spatial arrangement of the trap crop.

## RECENT STUDIES

The number of practical trials of trap cropping has increased rapidly in recent years. These have ranged from single rows of early-planted trap crop potatoes between current and previous year fields for Colorado potato beetle control (Mishanec 2003) to perimeter trap cropping against pepper and cucurbit pests (Boucher 2003, Boucher and Durgy 2003). Results have been good in both university and grower trials on these crops but these methods should be tested on more commercial fields in order to assess any limitations.

The cucurbit work for control of the striped cucumber beetle (SCB) is of particular interest. Full field-circling perimeter trap crops of Blue Hubbard

squash established around summer squash or cucumber fields have shown some success. These highly attractive perimeter trap crops are sprayed when SCB arrives, but interior crop plants are not. Crop plants have shown low pest damage even with no spray (Boucher 2003). Note that these trials have been carried out with conventional insecticides that are highly toxic to SCB and the results may not transfer fully to organic management. However, if a product such as Pyganic® is used against SCB, costs may be greatly reduced in a perimeter trap crop system. It is important to note that Blue Hubbard squash is the preferred trap crop for SCB because it does not contribute to the spread of bacterial wilt.

The use of trap crops may be limited in some crops because of the complexity of attempting to manage multiple pests with different behaviors. For example, the use of yellow rocket may provide good control of the diamondback moth but not the imported cabbageworm. However, trap cropping should be investigated as a component of an overall management program of pest management. There has been a recent increase in publications in this area. A symposium at the annual meeting of the Entomology Society of America in 2003 highlighted some applications and provided some new ideas about trap cropping that may be helpful to growers. (ESA 2003). Although there are no hard and fast guidelines on how to use trap cropping effectively, growers should consider the 5 points mentioned above and then examine their particular farming situation carefully and determine whether trap cropping should be tested on their farm. Sharing experience on trap cropping with other farmers should be part of an overall effort to increase our collective knowledge about the potential for trap cropping as part of an overall management plan.

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